CLAIMS

I CLAIM:

1. A compass system comprising:

at least one magnetic sensor;

a tilt sensor;

a memory;

a processor; and

at least one value for the Earth's field strength stored in the memory; and

a set of instructions stored in the memory and executable by the processor to calculate a magnetic field component, Z, that is orthogonal to the 2-axis magnetic sensor measurement axes using inputs from the 2-axis magnetic sensor and using the at least one stored value for the Earth's magnetic field strength.

2. The system of claim 1, wherein the at least one magnetic sensor is a 2-axis magnetic sensor.

3. The system of claim 2, wherein the orthogonal field component Z is calculated as $Z = \sqrt{H^2 - X^2 - Y^2}$ where H is the at least one stored value, X is a first measurement from the 2-axis magnetic sensor and Y is a second measurement from the 2-axis magnetic sensor that is orthogonal to X.

4. The system of claim 3, further comprising calculating local horizontal

components of the Earth's magnetic field using the calculated value of Z and inputs from the tilt sensor.

5. The system of claim 4, wherein the tilt sensor is a 2-axis tilt sensor that measures pitch (Φ) and roll (θ) angles and wherein the local horizontal components X_{comp} and Y_{comp} are mutually orthogonal and are calculated using the equations;

$X_{comp} = X\cos\Phi + Y\sin^2\Phi - Z\cos\theta\sin\Phi$ and

$Y_{comp} = Y\cos\theta + Z\sin.$

6. The system of claim 5, wherein a compensated heading is calculated using the equation

$Heading = arcTan(Y_{comp} / X_{comp}).$

7. A method of compensating for tilt in an electronic compass having a 2-axis magnetic sensor and a tilt sensor, the method comprising:

storing at least one value for the Earth's magnetic field strength;

measuring the Earth's magnetic field strength with the 2-axis magnetic sensor; and

calculating a magnetic field component, Z, that is orthogonal to the 2-axis magnetic sensor measurement axes using the measured field strengths from the 2-axis magnetic sensor and using the at least one stored value for the Earth's magnetic field strength.

8. The method of claim 7, further comprising:

calculating the orthogonal field component Z using the equation $Z = \sqrt{H^2 - X^2 - Y^2}$ where H is the at least one stored value, X is a first measurement from the 2-axis magnetic sensor and Y is a second measurement from the 2-axis magnetic sensor that is orthogonal to X.

9. The method of claim 8, further comprising:

calculating local horizontal components X_{comp} and Y_{comp} of the Earth's magnetic field using the calculated value of Z and inputs from the tilt sensor, wherein the tilt sensor is a 2-axis tilt sensor that measures pitch (Φ) and roll (θ) angles and wherein the local horizontal components X_{comp} and Y_{comp} are mutually orthogonal and are calculated using the equations;

$X_{comp} = X\cos\Phi + Y\sin^2\Phi - Z\cos\theta\ \sin\Phi$ and

$Y_{comp} = Y\cos\theta + Z\sin\theta.$

10. A method of compensating for tilt in an electronic compass having a 2-axis magnetic sensor and a tilt sensor, the method comprising:

storing at least one value for the Earth's magnetic field strength;

measuring the Earth's magnetic field strength with the 2-axis magnetic sensor;

calculating a magnetic field component, Z, that is orthogonal to the 2-axis magnetic sensor measurement axes using the measured field strengths from the 2-axis

magnetic sensor and using the at least one stored value for the Earth's magnetic field strength, wherein the orthogonal field component Z is calculated using the equation $Z = \sqrt{H^2 - X^2 - Y^2}$ where H is the at least one stored value, X is a first measurement from the 2-axis magnetic sensor and Y is a second measurement from the 2-axis magnetic sensor that is orthogonal to X;

calculating local horizontal components X_{comp} and Y_{comp} of the Earth's magnetic field using the calculated value of Z and inputs from the tilt sensor, wherein the tilt sensor is a 2-axis tilt sensor that measures pitch (Φ) and roll (θ) angles and wherein the local horizontal components X_{comp} and Y_{comp} are mutually orthogonal and are calculated using the equations;

$X_{comp} = X\cos\Phi + Y\sin^2\Phi - Z\cos\theta\,\sin\Phi$ and

$Y_{comp} = Y\cos\theta + Z\sin\theta$; and

calculating a compensated heading using the equation

$Heading = arcTan(Y_{comp} / X_{comp})$.